The ab-plane and c-axis FIR Conductivity of the CMR Manganite $La_{1.2}Sr_{1.8}Mn_2O_7$.

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Results: The ab plane and c-axis conductivities (σ_1) were measured by FT-IR ellipsometry for a single crystal of the layered CMR (colossal magneto-resistance) manganite $La_{1.2}Sr_{1.8}Mn_2O_7$ over the energy range of 20cm^{-1} to 5000cm^{-1} and at several temperatures. This material has a concurrent metal-insulator, ferromagnetic-paramagnetic transition at 125K. Shown in Figures 1 and 2 respectively are the ab plane and c-axis measurements of σ_1 in the far infrared region, a frequency range chosen because it highlights the main differences between spectra measured by ellipsometry and by normal incidence reflectivity for this material [1,2]. Ellipsometry directly measures the optical constants and thus is free from low frequency extrapolation errors that are inherent in KK transformed conductivities.

The ab plane σ_1 shows an increased spectral weight as temperature decreases, reflecting this material's metallic-like character at low T. However the low frequency absorption feature is non-Drude-like and strong electron-phonon coupling must be incorporated to explain this behaviour. With ellipsometry we can also better resolve increases in c-axis spectral weight seen around 250cm^{-1} and 450cm^{-1} and a split in the c-axis phonon at 500cm^{-1}. These behaviours may be extremely important in elucidating the role that electron-phonon coupling plays in conduction for these correlated electron systems.

References: [1] T. Ishikawa, T. Kimura, T. Katsufuji, and Y. Tokura, Phys Rev B, **57**, *R8079*, 1999; [2] H.J. Lee, K.H. Kim, J.H. Jung, T.W. Noh, R. Suryanarayanan, G. Dhalenne, and A. Revcolevschi, unpublished, 2000.

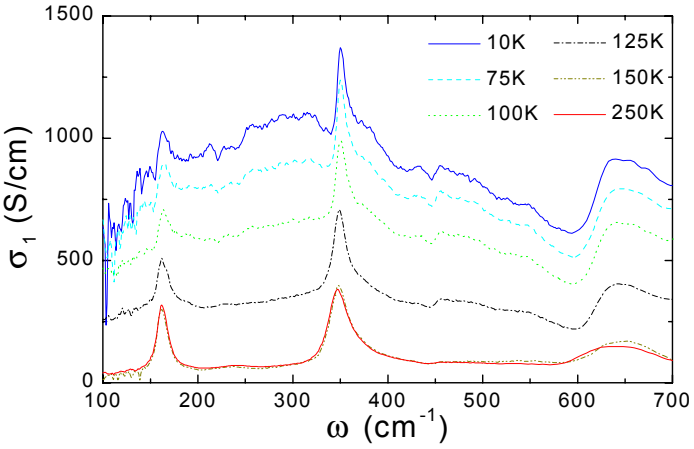

Figure 1. ab plane conductivity of $La_{1.2}Sr_{1.8}Mn_2O_7$.

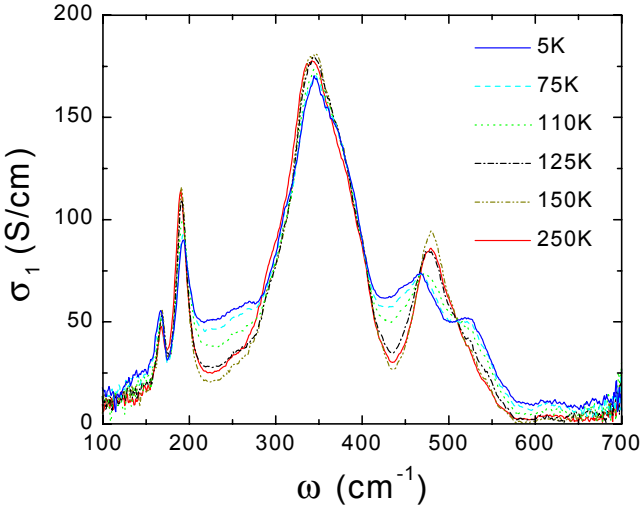

Figure 2. c-axis conductivity of $La_{1.2}Sr_{1.8}Mn_2O_7$.